Remarks/Arguments

This Amendment is responsive to the Office Action mailed March 31, 2005.

In the Action, the Examiner purported to act only on claims 23-27. Claims 1-22 and 28-30 were withdrawn from consideration.

The Examiner first suggested that the title be changed to "A Method of Forming an Electric Motor". In response, the title has been changed to -- Method of Forming an Electric Motor --. This should substantially comply with the suggestion of the Examiner.

Turning now to the rejections based on prior art, the Examiner rejected claims 23 and 27 under 35 U.S.C. § 102(b) as being allegedly "anticipated" by U.S. Pat. No. 5,592,731 (Huang *et al.*). Here, the Examiner said:

> "**As applied to claim 23,** the '731 teaches a method of constructing a stator, comprising:
> • compacting or pressing (Col. 5, lines 20-22) one or more powdered metallic materials to form a stator having at least two stator segments (Fig. 4a, 20), each stator segment having one or more teeth that form a substantially toroidal or circular path for magnetic flux entering or exiting the stator segment and each stator segment having a respective continuous insulated electric winding by lap winding (Col. 7, lines 58-62) for forming a magnetic field within the stator segment when said winding is electrically energized; and
> • placing or accommodating an inside rotor (Abstract) capable of producing a second magnetic field and having at least two magnetic poles (Col. 2, lines 12-15) in a cooperative relationship with the stator such that magnetic poles of the rotor interact with the magnetic field within the stator element.
> **As applied to claim 27,** the '731 teaches that the rotor has magnetic poles created by permanent magnets (Col. 2, lines 12-14)."

The Examiner further rejected claims 24-26 under 35 U.S.C. § 103(a) for defining a method that would have been allegedly "obvious" over Huang. Here, the Examiner said:

> "**As applied to claims 24-26,** the '752 teaches a method of constructing a stator, which reads on Applicant's claimed invention, including the compaction of metallic powder into stator segments by a die (col. 5, lines 19-22), except for applying the dynamic magnetic compaction (DMC) process with embedded wirings, which is well known in the art (Applicant's Related Art, page 2, lines 9, 17-22).
>
> It would be obvious to one of ordinary skill in the art at the time the invention was made to apply the dynamic magnetic compaction (DMC) process with embedded wirings in order to form a variety of components' shapes for the stator or rotor segments and reduce production time."

In response to the foregoing, claims 23-27, as well as the other withdrawn claims, have been canceled in favor of new claims 31-36. For the Examiner convenience, original claims 23-27 and new claims 31-36 are displayed in a side-by-side format herebelow:

Original Claims	New Claims
23. A method of forming an electric motor comprising:	31. The method of forming an electric motor, comprising the steps of:
compacting one or more powdered metallic materials to form a stator having at least two stator segments, each stator segment having one or more teeth that form a substantially toroidal path for magnetic flux entering or exiting the stator segment and each stator segment having a respective continuous insulated electric winding for forming a magnetic field within the stator segment when said winding is electrically energized; and	forming a plurality of arcuate stator segments, each segment having a concave surface, a convex surface, opposite end surfaces, and a plurality of teeth extending inwardly from said concave surface; providing each segment with an electrical winding having different portions that are arranged adjacent said concave, convex and end surfaces, said winding being adapted to be selectively energized to form a three-dimensional magnetic field about said winding; assembling said segments to form an annular stator; and
placing a rotor capable of producing a second magnetic field and having at least two magnetic poles in a cooperative relationship with the stator	placing a rotor within said stator, said stator having at least two magnetic poles that are arranged to interact with the magnetic field in said

such that magnetic poles of the rotor interact with the magnetic field within the stator element.

stator.

32. The method as set forth in claim 31 wherein said segments are formed by compacting at least one powdered metallic material.

24. The method of claim 23, wherein compacting one or more powdered metallic materials is performed by dynamic magnetic compaction.

33. The method as set forth in claim 32 wherein said segments are formed by a dynamic magnetic compaction technique.

25. The method of claim 24, wherein the associated continuous insulated electric winding is embedded within each stator segment.

34. The method as set forth in claim 31 wherein said winding is embedded within the associated stator segment.

26. The method of claim 23, wherein the associated continuous insulated electric winding is embedded within each stator segment.

35. The method as set forth in claim 31 wherein said winding is mounted on the associated stator segment.

27. The method of claim 23, wherein the rotor has magnetic poles created by one or more permanent magnets.

36. The method as set forth in claim 31 wherein said rotor has a permanent magnet, and wherein said magnetic poles on said rotor are created by the poles on said magnet.

As can be seen from the foregoing, claims 31-36 generally correspond to claims 23-27. There are, however, several significance points of departure. First, claim 31 no longer requires that the stator be formed by "compacting one or more metallic materials to form a stator having at least two stator segments". Rather, new claim 31 simply calls for "forming a plurality of arcuate stator segments", without specifying how those stator segments are formed. The compaction step is brought in by dependent claim 32, and dynamic magnetic compaction is brought in by dependent claim 33. Accordingly, claim 31 is not limited to compacting one or more powdered metallic

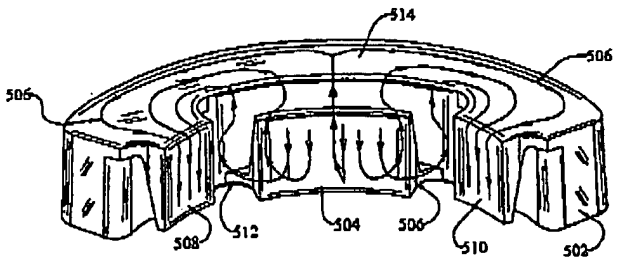
materials to form a stator. The stator could, for example, be formed by hot isostatic pressing technique, or machined from stock, or formed by some other technique.

Secondly, on further reflection, it is felt that the word "toroidal" may not be technically apt to describe the flux path of a particular segment. Certainly the segments, when assembled together to form a stator, would have an aggregate toroidal flux path. However, the salient here is that the flux path is three-dimensional, as opposed to two-dimensional, such as shown in the prior art. There is a literal antecedent for "three-dimensional flux path" in paragraphs 20, 21 and 42, *inter alia*. The prior art two-dimensional flux path was mentioned in paragraphs 0018 and 0041:

> [0018] As shown above, many electromagnetic devices formed by DMC and methods of forming such devices through DMC are disclosed in existing documents. Specifically, most conventional art discloses the use of DMC to form electromagnetic parts such as stators, rotors, inductors and transformers that contain embedded insulated windings. The documents referenced above disclose stators or rotors with embedded electrically insulated windings or shapes formed of magnetic material through the DMC process; however, conventional stators, whether formed of a series of plates, traditional compaction techniques or by DMC, are generally devices with two-dimensional (non-axial) flux paths having complex winding patterns that require significant motor assembly and manufacturing resources.
>
> * * *
>
> [0041] The primary operating principle of electric motors is the interaction of the magnetic fields of the stator and the rotor. In a traditional cylindrical stator, the magnetic field of the stator is established in the stator core by currents introduced in the windings in slots about the "teeth" of the core of the stator member in a manner such that they effect a pseudo rotation of the magnetic field about the inner circumference of the stator. The rotor is caused to physically rotate by the pseudo rotation of the magnetic field of the stator as the magnetic poles of the rotor are attracted to the opposite magnetic poles of the stator's magnetic field and repelled by the like poles of the stator's magnetic field. In the vast majority of electric motors today, the stator member is cylindrical in shape and substantially encompasses the rotor. In these electric motors, the stator member is generally comprised of a magnetic core material forming a number of "teeth" and "slots" that are parallel to the axis of the rotor. The magnetic field of the stator member is established by

windings in the slots around the teeth of the stator member. The magnetic field of the stator member thus established is two-dimensional in a plane perpendicular to the axis of the motor. The stator member is generally formed of thin laminations to reduce losses due to induced eddy currents within the stator. These thin laminations form a two-dimensional path for magnetic flux induced by the windings of the stator. This flux generally flows in a path perpendicular to the axis of the rotor from the stator and into the rotor, or from the rotor and into the stator.

Another point of patentable distinction lies in the shape of the winding. New claim 31 specifies that each arcuate stator segment have a concave surface, a convex surface, opposite end faces and a plurality of teeth extending inwardly from the concave surface. This is clearly shown in Fig. 5, which is reproduced in the insert:



As can be clearly seen from Fig. 5, the illustrated stator segment has an outwardly-facing convex surface, an inwardly-facing concave surface, left and right end surfaces, and a plurality of teeth, indicated at 508, 504 and 510, extending inwardly from the concave surface. These "teeth" are, in reality, polepieces through which the rotor flux communicates with the stator.

Claim 31 specifies that each segment is provided with an electrical winding having different portions that are arranged adjacent concave, convex and end surfaces. The configuration of the "banana-shaped contour-following" winding is more clearly shown in the shaded photograph on the following page.

Thereafter, the claim requires that the segments be assembled to form an annular stator, and that a rotor be placed within the stator, with the stator having at least two magnetic poles that are arranged to interact with the magnetic field in the stator.

New claim 31 clearly and unequivocally distinguishes from the fair prospective teaching of Huang. Huang discloses a conventional stator having a plurality of conventional teeth, with the coils being wound around the teeth. This is the two-dimensional arrangement described in Applicant's specification. More particularly, Huang does not disclose the three-dimensional magnetic field about the winding.

More importantly, Huang does not disclose a "banana-shaped contour-following" winding having various portions that are arranged adjacent to the concave, convex and end surfaces of the stator segment. Nor does Huang disclose such a winding that is adapted to be selectively energized to form a three-dimensional magnetic field about the winding.

These features are not shown in Huang or any of the other references cited by the Examiner. Accordingly, claim 31 is believed to patentably distinguish from the art-of-record. Claims 32 and 33 bring out the compaction and dynamic magnetic compaction techniques, respectively. Claim 34

simply specifies that the winding is embedded within the associated stator segment. Claim 35 specifies that the winding is mounted on the associated stator segment.

Thus, each of new claims 31-36 is clearly and unequivocally supported by the original disclosure.

This Amendment is believed to be fully responsive to the Office Action of March 31, 2005; is believed to squarely address each and every ground for objection or rejection raised by the Examiner; and is further believed to materially advance the prosecution of this application toward immediately allowance.

Formal allowance of new claims 31-36 is, therefore, courteously solicited.

Respectfully submitted,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I certify that this correspondence is being transmitted by facsimile transmission to Telephone No. 703-872-9306 on June 14, 2005.

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